Los Alamos NATIONAL LABORATORY EST.1943

Business Opportunities

High-Nitrogen Energetic Materials

Executive Overview:
The energetic materials found in fireworks, explosives, and propellants are ordinarily associated with dangerously high sensitivity and abundant pollution. The high carbon content of traditional energetic materials leads to the formation of carbon dioxide, carbon monoxide, and unburned carbon particulates (soot) and, in the case of most fireworks, the formation of irritating sulfur dioxide gas. As the name suggests, high-nitrogen energetic materials contain a high percentage of nitrogen by weight. The main combustion product is typically nitrogen gas (N_2), the most abundant gas in the earth's atmosphere.

In addition to application in traditional energetic applications, high-nitrogen materials find utility as precursors in the fabrication of materials such as nitrogen-rich carbon nitrides, carbon nanoparticles, and nanostructured metal foams. Los Alamos National Laboratory (LANL) is now offering its extensive portfolio of high-nitrogen energetic material technology for licensing and collaboration.

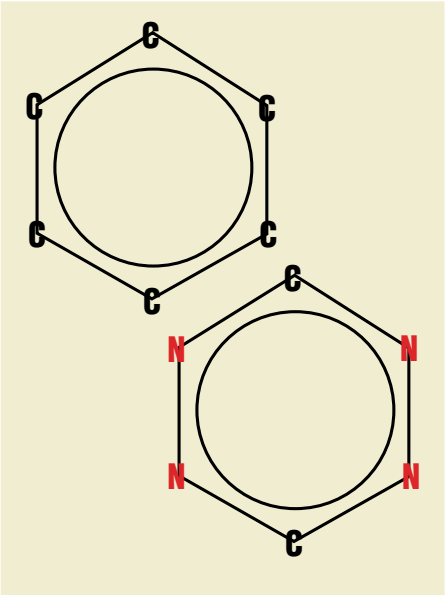
By working with LANL, companies gain access to innovative high-nitrogen energetic material technology while minimizing R&D risks and expenditures. Our partners gain access to a leading energetic materials research team, as well as to the Laboratory's extensive intellectual property (IP) portfolio. We invite you to explore energetic material business opportunities available with LANL today.

Select LANL High-Nitrogen Energetic Material IP:

- 3,6-BIS(1H-1,2,3,4-tetrazol-5-ylamino)-1,2,4,5-tetrazine or salt thereof [US patents 6,458,227 and 6,657,059]
- Use of 3,3'-diamino-4-4'-azoxyfurazan and 3,3'-diamino-4,4'-azofurazan as insensitive high explosive materials [US patents 6,358,339 and 6,552,201]
- Preparation of 3,3'-azobis(6-amino-1,2,4,5-tetrazine) [US patent 6,342,589]
- Synthesis of 3,3,-dinitroazetidine [US patent 5,395,945]
- Synthesis of 1,3,3-trinitroazetidine [US patent 5,336,784]
- Microthruster propellant [patent pending]
- Use of 2,4,8,10-tetranitro-5H-pyrido[3',2':4,5][1,2,3]triazolo[1,2-a] benzo-triazol-6-ium, inner salt as a thermally stable high explosive [patent pending]
- Use of 4,4 6,6-tetra(azido)azo-1,3,5-triazine and 3,6-di(azido)-1,2,4,5-tetrazine to prepare carbon nitrides and nano-materials [patent pending]
- nanoFOAM: Combustion synthesis of nano-structured metal foams [patent pending]
- Preparation of Energetic Nanopowders [Patent Pending]

Partnership Mechanisms:

Licensing Agreements
Non-Federal Work-for-Others (WFO) Agreements
Cooperative Research and Development Agreements (CRADA)



The comparison between a benzene (upper) and tetrazine (lower) ring demonstrates the nitrogen-rich nature of tetrazine. Despite the superficial resemblance, tetrazine derivatives often exhibit dramatically improved performance and utility compared with traditional energetic materials.

Select Applications:
Pyrotechnics
Air bag propellants
Microthruster propellants
Nitrogen-based fire suppression
Nitrogen-rich carbon nitrides
Carbon nanoparticle production
Nanostructured metal foams
Explosives
Fuel Cells

Capabilities:
High-nitrogen compound synthesis
Energetic material characterization
Shock wave analysis
Nanomaterial synthesis

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